BOTANY.[1]

Peridial Cell Characters in the Classification of the Uredineæ.—In the genus *Roestelia* peridial cell characters are frequently given considerable prominence, and surely frequently add to the certainty of our identification. The question then naturally arises, why are not such characters valuable in the related genus *Æcidium*, where if anywhere in the *Uredineæ* we need all possible characters for certainty in identification.

The characters most frequently used are position and size of æcidia, size and outward appearance of spores, and most important of all, on what host plant. All are very variable, even the latter and most important one, many rusts sometimes occurring on the same host, and frequently the same rust on many hosts. The position—hypoplyllous, amphigenous, or epiphyllous—is changeable, determined, I think, largely by the character of the leaf, as I have shown elsewhere. The size of the æcidia varies also with a change of host-plant and immediate conditions of moisture and heat, as do also the æcidiospores.

What are the peridial cells? They are very likely, as usually supposed, slightly modified chains of æcidiospores loosely attached into a surrounding pseudo tissue layer for protection. This is readily believed when we observe that the peridial cells usually partake, more or less of the character of the æcidiospores, in shape, thickness of wall, roughness or smoothness, etc., and from their breaking apart readily into chains appearing much as the æcidisopores. Believing thus that the peridial cells are developed from the æcidisopores what would seem more natural than that we should examine and describe them as we do the æcidiospores.

In the examination of Uredineæ I have noticed that while the peridial cells are usually very similar in shape and size (yet no more so than the æcidiospores), they are frequently quite characteristic.

In *Æcidium pentstemonis* for instance, the peridial cells are angular, subrotund-elliptical, thick walled, smooth, 19–22 by 22–31 μ., while in the Æcidium *Puccinia tanaceti* D.C., on *Artemisia cana* and *A. canadensis* they are subrotund-angular, 15–21 by 19–26 μ., being very similar to the last, but distinguished by size, being in general smaller. In *Æcidium compositarum* Mart. var. *lygodesmiæ* Webber, they are angular-elliptical and usually strongly tuberculate, distinguished from the pre-

[1] Edited by Prof. C. E. Bessey, Lincoln, Neb.

ceding by shape and character of the surface. In *Æcidium euphorbiæ* Gmel. they are similar to those of the preceding species, but the cells are shorter (15–20 by 19–25 μ.), and not so strongly tuberculate. In many species characteristic differences may be be found. Why not describe them?—HERBERT J. WEBBER, *Lincoln, Neb.*

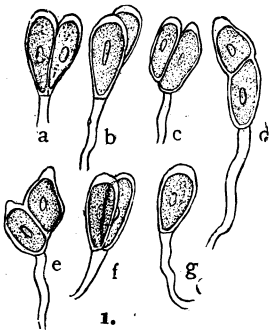
Peculiar Uredineæ.—An abnormal fruit or seed, as a double apple or walnut, is always noted with curiosity by the most untrained observer; so are also such stable but uncommon developments as the navel-orange. Among lower plants the microscopic spores frequently present peculiarities as curious as these, yet although examined usually by careful observers only, they are seldom noted with anything more than usual interest.

In working over Nebraska Uredineæ I have observed a few curious variations from the usual forms that I think deserve particular mention.

Puccinia flaccida B. & Br. (Pl. VIII., Fig. 1, Teleutospores; Fig. 2, Uredospores), a very peculiar species, presents the greatest and most uniform or stable peculiarity from the normal Puccinia, if I may so express it, of any species that it has been my fortune to examine. My specimens were collected at Lincoln, Nebraska, Oct. 13, 1889, on Barnyard-grass (*Panicum crus-galli*). The sori are amphigenous, linear-oblong, small and rather inconspicuous. The teleutospores are frequently one-celled (Fig. 1, *g.*), and in this case are of nearly the same size as the two-celled spores. The septi of two celled spores are in various positions, from almost horizontal to vertical. I have never found onewith a strictly horizontal septum. They are quite frequently almost vertical, each cell attached in part to the pedicel (Fig. 1 *a.* and *f*). In this case they appear as double Uromyces spores. In fact the species seems to me to more resemble a Uromyces than a Puccinia, the one-celled spores, which are always plentiful, being the normal form, and the two-celled spores, with the nearly vertical septi, double spores. About as near an approach to the normal Puccinia as usually occurs is represented by Fig. 1, *d*, and even here the partition is quite oblique.

Burrill, in "Parasitic Fungi of Illinois, Uredineæ," p. 202, says of this: "A most peculiar species. From two-thirds to three-fourths or more of all the teleutospores are septate, presenting the most varying and aberrant forms. So far as we are informed this has not been previously reported from America, but a comparison with specimens kindly furnished by Dr. M. C. Cook of *Puccinia flaccida* B. & Br. from Ceylon, leaves no doubt of the specific identity. The American specimens only differ in possessing more undivided and, upon an average, narrower teleutospores, with somewhat thicker pedicels."

PLATE VII.



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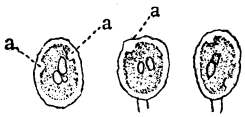

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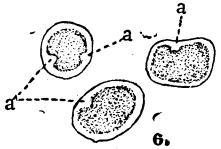

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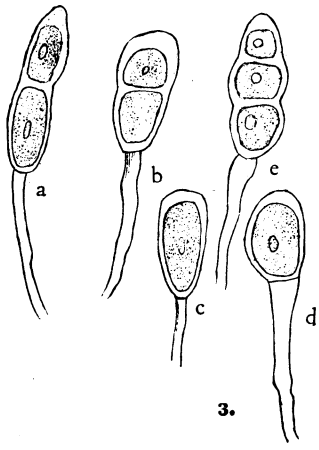

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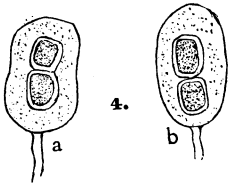

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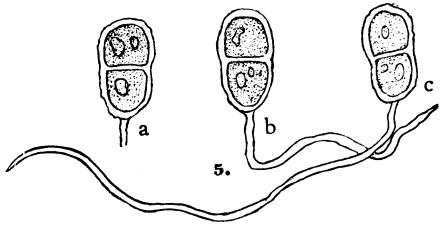

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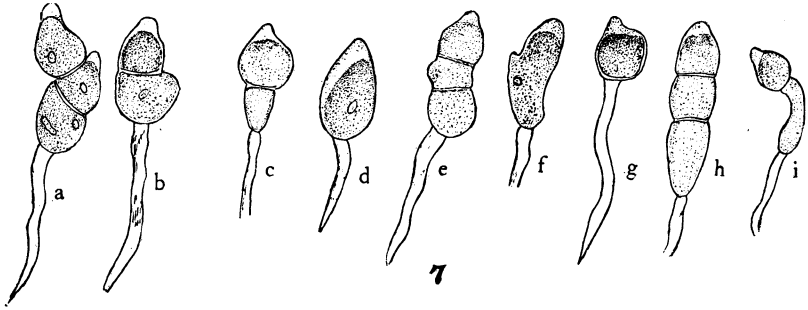
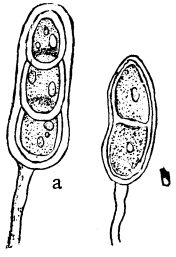


7



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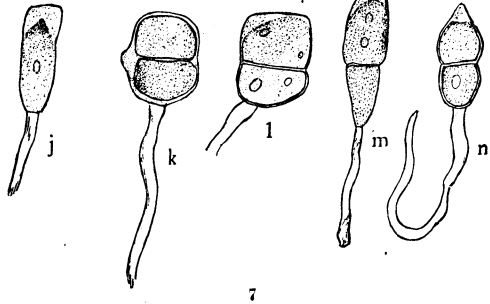

7

The uredospores of this species also illustrate an interesting feature, sometimes occurring among Uredineæ,—the so-called "*germ pores*" (Fig. 2, *a*), two or more hyaline points in the wall of the spore. The spore thus greatly resembles a pollen grain, the points being very likely analogous to the similar thickenings on the pollen grain, furnishing a spot for the breaking through of the tube in germination.

This peculiar feature is found also in the uredospores of *Puccinia prenanthis* (Pers.) Fuckel (Fig. 6, *a*, from specimens collected at Anselmo, Nebraska, July 8, '89). The æcidium of this species is also peculiar, from its lack of genuine pseudoperidium. In the place of the usual pseudoperidium a pseudoparenchymatous hyphæ mass occurs. This is probably the *Æcidium hemisphericum* Pk.

In *Puccina sporoboli* Arthur, (Fig. 3) I find one-, two- and three-celled teleutospores. This species is peculiar in that some of the sori bear only one celled teleutospores (Fig. 3, *c*, and *d*), while others bear only the normal two-celled teleutospores (Fig. 3., *a* and *b*), and still others produce a sometimes almost equal mixture of one- and two-celled teleutospores, with frequently also three-celled ones (Fig. 3, *e* represents a three-celled teleutospore measuring 26.6 by 14.4 μ.) This peculiarity of one- and two-celled spore-sori I find only on specimens growing on *Sporobolus vaginæflorus*, collected at Lincoln, Nebraska, October 13, 1889. Other specimens of the same species on *Sporobolus asper* and *Sporobolus cryptandrus* have only the two-celled teleutospores. Dr. Arthur in the original description from specimens on *Sporobolus heterolepis* mentions the same peculiarity.

Puccinia tanaceti D. C., var. *actinellæ* Webber, on *Actinella acaulis* furnishes in the same sorus a remarkable variety of teleutospores, the contortions being almost as various as those of *Puccinia flaccida*, though not so frequent. Fig. 7, *an*, shows some of the various forms of the teleutospores; (*a*) is a three-celled spore with two apical apices, the upper cell seems as if grown from the side of the middle cell; (*b*) is almost normal, with basal cell large; (*c*) with large apical cell; (*d*) one-celled; (*e*) three-celled, 21 by 50 μ.; (*f*) one-celled, with side point, 19 by 45 μ.; (*g*) one-celled, 26 by 28 μ.; (*h*) three-celled, 19 by 76 μ.; (*i*) curved, lower cell abortive; (*j*) one-celled, 19 by 53 μ.; (*k*) large, truncate, with side point, 38 by 45 μ.; (*l*) large truncate, 30 by 42 μ.; (*m*) normal spore, 19 by 70 μ.; (*n*) normal spore, 22 by 49 μ.

The teleutospores of the genus *Uropyxis* are exceedingly interesting and important as being one of the main proofs from spore resemblance that the Uredineæ are degraded Ascomycetes, the teleutospore

stage being the homologue of the spore fruit, the teleutospore of the ascus and the teleutospore cells of the ascospores. The clear outer pellicle here greatly increases the resemblance to the ascus. A few weeks ago while examining *Uropyxis petalostemonis* (Farl.) D. By., a three-celled teleutospore was observed (Fig. 8, *a*). The resemblance of the normal form to the ascus is plain, but here it was indeed striking, the walls of the cells were so plainly distinct from the pellicle and that of one cell from the other cells. The spores could plainly be seen to overlap as they lay surrounded by the clear pellicle, the spore sac or ascus.

In many teleutospores, if not in all, an outer surrounding sac entirely separate from the enclosed spores may be differentiated. It may readily be seen by heating the spores for a few moments before mounting in nitric acid. In spores thus treated the wall swells out, leaving the spores within clearly distinct. Brownian movement may frequently be seen between the separated wall and the spores, indicating that it is not merely a swelling of the wall, but a separating, the space created being filled with a fluid. A teleutospore of *Puccinia jonesii* Pk. treated in the above manner is represented by Fig. 4, *a*. Three of the normal spores are shown in Fig. 5. Another peculiar feature of this species is its long and exceedingly fragile pedicels (Fig. 5, *b* and *c*). They were described by Peck originally as exceedingly short (Fig. 5, *a*), the mistake being caused undoubtedly by their easy deciduous character. In type specimens, it was only by long soaking and repeated attempts that I obtained the pedicels attached (See Ellis, N. A. F., No. 1448). In Nebraska, specimens on *Musenium tenuifolium* while fresh, I with but little difficulty, found them attached.

Spores of *Puccinia nigrescens* Pk., a typical Puccinia, treated in nitric acid, presented the same peculiar swollen appearance (Fig. 4, *b*).

Typical Puccinia spores prepared as above greatly resemble spores of Uropyxis. Schröeter, in Hedwigia, 1875, p. 65, separated *Puccinia amorphæ* Curt. from Puccinia, placing it from the distinct outer hyaline layer of its spores in a new genus, which he called Uropyxis. To this genus one more species, *Uropyxis petalostemonis* (Farl.) De Toni. has since been added. Some mycologists think the difference between the two genera too slight to justify distinction. The difference at most is but slight, and when we treat Puccinia spores with nitric acid as above the distinction vanishes entirely. Are we then to consider Uropyxis as distinct from Puccinia merely because the spore is surrounded by an outer *distinct* layer, while in Puccinia the outer layer occurs but is indistinct?—HERBERT J. WEBBER, *Lincoln, Neb.*

Grasses of Box Butte and Cheyenne Counties, Nebraska. —On August 21st, 1889, I started out from Alliance, Neb., on a short trip of observation to determine particularly the grass flora of southern Box Butte and northern Cheyenne counties.

Alliance is about four miles east of the 103d meridian west of Greenwich, directly on the line of the 42d parallel. The town lies on a broad level plain, which appears to have been at one time the bed of a lake. Southward and eastward, from eight to ten miles distant, are the sand hills. To the west is the broad valley of Snake Creek, a creek which, like nearly all of the streams of this region, flows from the sand, rushes rapidly forward a few miles, and disappears, losing itself in the sand. North and northwestward the land rises toward Pine Ridge. The only apparent outlet of this lake basin is toward the east, in a pass through the sand hills.

On this level plain, parched and barren under the August sun, the principal grasses found were Gramma, *Bouteloua oligostachya* Torr., and its near relative *Bouteloua hirsuta* Lag., Buffalo-grass, *Buchloë dactyloides* Engelm., wild wheat grass, *Agropyrum glaucum* R. & S., and two others, very common, but of no agricultural value, a Beard-grass, *Stipa* sp.—near *comata* Trin., and prairie wire-grass, *Schedonnardus texanus* Steudel. The great bulk of the prairie grass was Gramma, and I was told that it is *the* pasture grass of the region.

On the morning of the day named, I went in company with Mr. Nelson Fletcher, of Alliance, to a natural meadow of about 350 acres, lying in the Snake Creek valley, just at the foot of the sand-hills southeast of the town. The ground was wet but not swampy, and the rank plant growth which covered it formed a pleasing contrast to the sweltering sandy slopes around the meadow. The chief grass was *Agropyrum glaucum*, which differed from the form found around Lincoln in having longer and less harsh leaves. Mixed with it were *Andropogon scoparius* Michx., *A. provincialas* L., *Muhlenbergia glomerata* Trin. *Elymus canadensis* L., and *Panicum virgatum* L.

With these grasses were tall golden rods, purple blazing stars, and white-flowered asters, altogether making a brilliant flowery oasis in a sandy desert. The growth was very even, from 2½ to 4 feet high. Mr. Fletcher said that although no hay is cut on the open prairies enough is obtained from these natural meadows, and it is hay of very good quality, so that the average price ranges from two to four dollars per ton.

About a mile east of this meadow stood what appeared to be a large field of corn, but on nearer approach it proved to be Reed grass *Phrag-*

mites communis Trin. This grass and cat-tail flags and rushes were quite common in the swampy meadows and around the numerous small lakes of the sand-hill region.

Along the valley of Snake Creek I found in addition to those already mentioned *Andropogon nutans* L., *Oryzopsis cuspidata* Beuth., *Sporobolus airoides* Torr., *S. vaginæflorus* Vasey, *S. asperifolius* N. & M., *S. asper* Kth., *Panicum capillare* L., *Setaria glauca* Beauv., *S. viridis* Beauv., *Deyeuxia canadensis* Beauv., *Distichlis maritima* Raf., and *Spartina cynosuroides* Willd.

In the sand-hills around Alliance the principal grasses are *Andropogon hallii* Hack., *A. provincialis* Lam., *A. nutans* L., *A. scoparius* Michx., *Sporobolus asper* Kunth, *Oryzopsis cuspidata* Bedth., *Bouteloua oligostachya* Torr., *Deyeuxia canadensis* Beauv., *Eragrostis tenuis* Gray, *Stipa comata* Trin., and on the higher hills, and particularly noticeable on the edge of the "blow-outs," *Muhlenbergia pungens* Thurb. In the clear white sand in the "blow-outs" *Redfieldia flexuosa* Vasey is found quite abundantly.

The best grazing grasses are Gramma and Buffalo-grass. Wild wheat grass is good for hay but not for pasture.

I did not find any Sand-burs. They are not needed, for Mammillaria and other cacti make life a burden.

From Alliance I went west along Snake Creek valley twelve or fifteen miles, then southwest through the extreme western extension of the sand-hills till I struck the old Black Hills trail at the head of Red Willow cañon, and thence down the Red Willow southeastward to the Platte. The only new find was *Munroa squarrosa* Torr., on the Platte side of the divide.

From the Camp Clarke, on the Platte, where the old Sidney-Black Hills trail crosses the river, I went south to Court House Rock and Pumpkin Creek. The rock is a great mass of light brown argillaceous sandstone, which rises about 300 feet sheer above the valley.

The ridge stretching westward, of which Court House Rock was once a part, at one time bore a forest of pine and cedar. Now there are only some stumps and a few scattered trees to show what has been before. In the cañons at the foot of Court House were *Rhus aromatica* Ait. var. *trilobata* Gr., and a number of woody shrubs and vines.

On the summit of the rock I found *Oryzopsis suspidata* Benth., *Agropyrum glaucum* R. & S., *Aristida purpurea* Nutt., a form with an erect culm rising from a mat of convolute wiry radical leaves, *Bouteloua racemosa* Lag., the first that I had seen, *B. oligostachya* Torr., and *Muhlenbergia pungens* Thurb.

By the side of the creek, at the base of the rock, I found *Eatonia obtusata* Gray, *Elymus canadensis* L., *Panicum virgatum* L., *P. crus-galli* G., and *P. crus-galli* var. *hispidum* Gr., *Aristida purpurea* Nutt., *Bouteloua oligostachya* Torr., *Munroa squarrosa* Torr., *Oryzopsis cuspidata* Benth., *Sporobolus airoides* Torr., and *Cenchrus tribuloides* L.

The Sand-burs have probably been introduced in the Pumpkin creek valley in the wool of sheep which have been herded there.

NOTES.—I did not find *Munroa* north of the Platte river valley. *Andropogon hallii* grew on the foot hills between Camp Clarke and the Court House ridge. These hills are sandy but are not true "sand hills," as that name is applied in the West.

Distichlis maritima is the chief pasture grass of the Platte valley in this vicinity! Other grasses, *Buchloë*, *Bouteloua oligostachya*, *Spartina cynosuroides*, *Agropyrum glaucum*, *Hordeum jubatum*, *Setaria glauca*, *S. viridis*, *Munroa squamosa*, and *Panicum crus-galli* also occur, but by no means as abundantly as the Distichlis.

I visited from fifteen to twenty of the islands in the river at this point. I found two grasses other than the common Platte valley species. They were *Glyceria distans* Wahl., and *Sporobolus depauperatus* Torr. The characteristic plant of these islands is *Shepherdia argentea*, a small shrubby tree known as the Buffalo-berry.—JARED G. SMITH, *Lincoln, Neb.*

ZOOLOGY.

The U. S. Fish Commission.—Anthozoa and Echinodermata of the Gulf Stream Slope of the New England Coast.—At various times during 1882, Prof. A. E. Verrill has given to the world notice of the remarkable marine fauna, to a great extent tropical in character, occupying the outer slope of the continental plateau off the southern coast of New England. The abundance of animal life on these banks may be judged from the fact that at a single haul, made on September 1, 1881, over ten thousand specimens were procured. In Prof. Verrill's words "a large number of species, belonging to various zoological groups, in this region are found living gregariously, in vast numbers, at particular spots, while they may not occur at all, or only sparingly, at other stations in similar depths, and apparently identical in temperature and character of bottom."

Among the discoveries of new and rare species during 1881, are the following Anthozoa: *Urticina longicornis*, *U. perdix*, *U. callosa*,